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(21)Application number : 08-202253 (71)Applicant : RIVER ELETEC KK

(22)Date of filing : 31.07.1996 (72)Inventor : WAKAO WATARU

MITSUI SHINYA

ASAKAWA YOSHITAKA

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(54) CRYSTAL VIBRATOR

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a crystal vibrator, consisting of crystal vibrator bars arranged horizontally which is free from its deformation, etc., caused by the difference in the coefficients of thermal expansion and can improve its reliability by supporting each vibrator bar only at one of its both ends while the other end is kept free.

SOLUTION: Every crystal vibrator bar 27 is set almost horizontally, and one of both ends of the bar 27 is not fixed and kept free and put on an inner lead 26b of a lead wire 25b. Then the bar 27 is fixed at one of its both ends and at the side of a lead wire 25a with the other end kept free. Thus, the bar 27 can absorb vibrations and therefore causes no distortions, etc. Furthermore, the bar 27 is directly fixed to a hermetic base 21 and an inner lead 26a, and the diameter of a through-hole 23 is larger than the diameters of both leads 26a and 26b. Thus, the dielectric strength of the bar 27 is secured, despite the reduction of the distance between the leads 26a and 26b and the hermetic base 21 respectively. As a result, the height of the bar 27 can be reduced, and therefore the overall height of the crystal vibrator can be reduced.

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**CLAIMS**  
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[Claim(s)]

[Claim 1] The quartz resonator characterized by supporting the above-mentioned quartz-resonator piece only by the end, and changing considering the other end as a free condition in the quartz resonator which comes to carry out horizontal-type arrangement of the quartz-resonator piece.

[Claim 2] In the quartz resonator which has the inner lead of the couple penetrated where a pedestal is insulated with this, and comes to arrange a quartz-resonator piece to a horizontal type The end of the above-mentioned quartz-resonator piece fixes into the part by the side of the inner lead of the method of up Norikazu, and one [ this ] inner lead of the above-mentioned pedestal. One electrode of the above-mentioned quartz-resonator piece flows in the inner lead of the method of up Norikazu. The quartz resonator with which the electrode of another side flows in the inner lead of above-mentioned another side through the above-mentioned pedestal, a cap is closed by

the above-mentioned pedestal, and the outside surface of the above-mentioned pedestal and this cap is characterized by the part or carrying out whole surface pre-insulation and changing.

[Claim 3] In the quartz resonator which has the inner lead of the couple penetrated where a pedestal is insulated with this, and comes to arrange a quartz-resonator piece to a horizontal type The end of the above-mentioned quartz-resonator piece fixes into the part by the side of the inner lead of the method of up Norikazu, and one [ this ] inner lead of the auxiliary conductive member allotted through the insulating member on the above-mentioned pedestal. The quartz resonator characterized by for one electrode of the above-mentioned quartz-resonator piece flowing in the inner lead of the method of up Norikazu, for the electrode of another side flowing in the inner lead of above-mentioned another side through the above-mentioned auxiliary conductive member, and for a cap being closed by the above-mentioned pedestal, and changing.

[Claim 4] The quartz resonator electrically characterized by connection and being fixed mechanically and changing with the electroconductive glue with which it has the inner lead of the couple penetrated where a pedestal is insulated with this, and the ends of the above-mentioned quartz-resonator piece have resiliency on the inner lead of a up Norikazu pair in the quartz resonator which comes to arrange a quartz-resonator piece to a horizontal type.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to a quartz resonator.

[0002]

[Description of the Prior Art] Generally, the quartz resonator is used for electric reference frequency generating and electric \*\*\*\*\* by combining with an electrical circuit using the piezo-electric effect and the inverse piezoelectric effect which the proper mechanical vibration and Xtal have.

[0003] As shown in drawing 21 , through the respectively stair-like conductive attachment component 4, the conventional quartz resonator carries out the hermetic seal of the quartz-resonator piece 5 with anchoring and the further metal cap 6, and is constituted at the inner lead side of two lead wire 3 which penetrates two bores 2 to the metal pedestal 1. The base which contains a pedestal 1, lead wire 3, and glass 9 here is generically called the hermetic base 15. In this case, a pedestal 1 is formed in one at a configuration with flange 1a which formed the height 8 over the perimeter. As flange 1a of this pedestal 1 and flange 6a of cap 6 are made to opposite-\*\* and it is shown in

drawing 22 , the projection 8 of flange 6a of cap 6 and flange 1a of a pedestal 1 is joined by resistance welding under about 200kg application of pressure with resistance welding equipment 7 equipped with up electrode 7A and lower electrode 7B, and the hermetic seal of the quartz-resonator piece 5 is performed.

[0004] In addition, lead wire 3 is made as [ aim at / glass welding is fixed in the bore 2 of a pedestal 1, and / the insulation with a pedestal 1 ]. A pedestal 1 is formed with iron (SPCC; cold rolled steel plate) or 42 alloy alloy. Lead wire 3 is formed with congenial covar (Fe-nickel-Co alloy) or a FeNi alloy with glass 9 etc. Installation fixing of the quartz-resonator piece 5 is carried out on an attachment component 4 by electroconductive glue 10.

[0005] Such a quartz resonator 11 is mounted in a printed-circuit board. For example, the stop and the pedestal 1 are made to float from a printed-circuit board in the location of the bending section, when an insulation sheet is prepared in the rear face of a pedestal 1 so that it may not connect with a circuit pattern too hastily, since a pedestal 1 is metal when a quartz resonator 11 is mounted in the double-sided printed-circuit board which has a circuit pattern to both sides, or the bending section is prepared in the medium of lead wire 3 and lead wire 3 is inserted in the lead insertion hole of a printed-circuit board.

[0006] After carrying out glass weld of the lead wire 3, forming the hermetic base 15 in a pedestal 1 and carrying out installation fixing of the quartz-resonator piece 5 on the attachment component 4 of lead wire 3 and one as a manufacture process of a quartz resonator 11, frequency regulation of the quartz-resonator piece 5 is performed, and the hermetic seal of the hermetic base 15 and the cap 6 is carried out by resistance welding after that.

[0007] At the time of this resistance welding, although about 200kg big application of pressure is cost and the rear-spring-supporter grain of the projection 8 of flange 1a is carried out to the perimeter, the unnecessary force will act on the projection 8 covering the perimeter of flange 1a of the hermetic base 15, and flange 6a of cap 6 at the quartz-resonator piece 5 in the condition of having already united with the hermetic base 15, in that case, and a frequency will be changed. In the hermetic base 15, it did not become ideal flatness by the production process, but curvature has arisen.

[0008] When curvature by which it follows, for example, ends turn to the hermetic base 15 caudad like the sign 13 of drawing 22 has arisen, the force a of going to the method of outside acts on the quartz-resonator piece 5, when having produced curvature by which ends are up fit for reverse like a sign 14 with the hermetic base 15, the force b of going to the inner direction will act on the quartz-resonator piece 5, this will accumulate, and the frequency of the quartz-resonator piece 5 will be changed. Since the frequency of the quartz-resonator piece 5 was set up to the order of ppm, the frequency beforehand set up also according to an operation of few force a and b was changed, and it had a possibility that variation might arise in quality.

[0009] Moreover, a difference of thermal expansion is between the iron which constitutes a pedestal 1, and Xtal which constitutes the quartz-resonator piece 5. An iron coefficient of thermal expansion is  $15 \times 10^{-6}$ , and, in parallel, perpendicularly, the coefficient of thermal expansion of Xtal is  $13.7 \times 10^{-6}$  on a shaft at  $7.5 \times 10^{-6}$  and a shaft. Thus, since the coefficient of thermal expansion of the quartz-resonator piece 5 is different from the pedestal 1, the stress by distortion will join the quartz-resonator piece 5 by change of temperature, and the frequency set up beforehand will be changed.

[0010] Moreover, in drawing 21, although the supporter material 4 has some elasticity by uniting with lead wire 3 and having the stair-like configuration, since it fabricates the upper part of lead wire 3 and is considering as the supporter material 4, the selectivity of an ingredient is restricted and it cannot acquire elasticity required as supporter material, i.e., the elasticity of extent which can follow the oscillation of the quartz-resonator piece 5. Here, although elasticity can also be somewhat given as a configuration which has hollow 4a for a part of part of a stair-like configuration as shown in drawing 23, elasticity too required as supporter material cannot be acquired.

[0011] Then, as the configuration near supporter material is shown in drawing 24 A and drawing 24 B, respectively, in order to free selection of the ingredient of the supporter material 4 and to enlarge elasticity of supporter material, 3t of upper bed sections of lead wire 3 was formed widely, and the configuration which makes the supporter material 4 which has elasticity on 3t of this upper bed section fix was able to be considered. Drawing 24 A mainly absorbs a vertical oscillation by the case where it considers as the stair-like supporter material 4. There is little absorption of a horizontal oscillation. Drawing 24 B absorbs a vertical oscillation and a vertical horizontal oscillation by the case where it considers as the supporter material 4 which has slant-face 4r in the middle of a stairway.

[0012]

[Problem(s) to be Solved by the Invention] However, with such a cure, all the above-mentioned troubles (the abnormalities in a property by difference of a coefficient of thermal expansion and the poor oscillation by the impact at the time of drop) cannot be solved, and fluctuation of a frequency cannot be prevented, either.

[0013] For solution of the problem mentioned above, by losing the stress applied to a quartz-resonator piece in this invention, there is no fluctuation of a frequency and the quartz resonator which made the miniaturization possible more is offered.

[0014]

[Means for Solving the Problem] In the quartz resonator which comes to carry out horizontal-type arrangement of the quartz-resonator piece, a quartz-resonator piece is supported only by the end and the 1st this invention changes considering the other end as a free condition.

[0015] Moreover, the 2nd this invention has the inner lead of the couple penetrated where a pedestal is insulated with this, and sets it to the quartz resonator which comes to

arrange a quartz-resonator piece to a horizontal type. The end of a quartz-resonator piece fixes into the part by the side of one inner lead and one inner lead of a pedestal. One electrode of a quartz-resonator piece flows in one inner lead, the electrode of another side flows in the inner lead of another side through a pedestal, a cap is closed by the pedestal, and a pedestal and the outside surface of a cap consider as a part or the configuration which whole surface pre-insulation is carried out and changes.

[0016] Moreover, the 3rd this invention has the inner lead of the couple penetrated where a pedestal is insulated with this, and sets it to the quartz resonator which comes to arrange a quartz-resonator piece to a horizontal type. The end of a quartz-resonator piece fixes into the part by the side of one inner lead and one inner lead of the auxiliary conductive member allotted through the insulating member on the pedestal. One electrode of a quartz-resonator piece flows in one inner lead, the electrode of another side flows in the inner lead of another side through an auxiliary conductive member, and it considers as the configuration which a cap is closed by the pedestal and grows into it.

[0017] Moreover, the 4th this invention has the inner lead of the couple penetrated where a pedestal is insulated with this, and the ends of a quartz-resonator piece consider it as connection and the configuration which is fixed mechanically and changes electrically on the inner lead of a couple with the electroconductive glue which has resiliency in the quartz resonator which comes to arrange a quartz-resonator piece to a horizontal type.

[0018] According to the 1st above-mentioned this invention, when the quartz-resonator piece which carried out horizontal-type arrangement is supported only by the end and makes the other end a free condition, fluctuation of the frequency of the quartz resonator on the production process resulting from the curvature and distortion of the above-mentioned pedestal can be lost.

[0019] According to the 2nd above-mentioned this invention, the end of a quartz-resonator piece has fixed into the part by the side of one inner lead and one inner lead of a pedestal, the other end of a quartz-resonator piece is free, and fluctuation of the frequency of the quartz resonator on the production process which originates in the curvature and distortion of the above-mentioned pedestal like the 1st this invention can be lost. and -- from the two electrodes of a quartz resonator since one electrode of a quartz-resonator piece flowed in one inner lead and the electrode of another side has flowed in the inner lead of another side through a pedestal -- respectively -- on the other hand, as for another side, a flow is directly made by the inner lead through a pedestal. Furthermore, since a pedestal is penetrated after the inner lead has insulated with the pedestal, and pre-insulation of a pedestal and the outside surface of a cap is carried out, the insulation with the circuit board linked to the exterior of an inner lead and a quartz resonator and a pedestal is made.

[0020] According to the 3rd above-mentioned this invention, the end of a

quartz-resonator piece has fixed into the part by the side of one inner lead and one inner lead of the auxiliary conductive member allotted through the insulating member on the pedestal, the other end of a quartz-resonator piece is free, and fluctuation of the frequency of the quartz resonator on the production process which originates in the curvature and distortion of the above-mentioned pedestal like the 1st this invention can be lost. and -- from the two electrodes of a quartz resonator since one electrode of a quartz-resonator piece flowed in one inner lead and the electrode of another side has flowed in the inner lead of another side through an auxiliary conductive member -- respectively -- on the other hand, as for another side, a flow is directly made by the inner lead through an auxiliary conductive member.

[0021] Since the ends of a quartz-resonator piece fix to the inner lead of a couple with the electroconductive glue which has resiliency according to the 4th above-mentioned this invention, stress is absorbed by the resiliency of adhesives and fluctuation of the frequency of the quartz resonator on the production process resulting from the curvature and distortion of the above-mentioned pedestal can be lost. And since adhesives have conductivity, a flow with a quartz-resonator piece and an inner lead is made.

[0022]

[Embodiment of the Invention] The quartz resonator of this invention prevents the distortion and deformation in a production process, it is the object which makes it possible to absorb an oscillation, a quartz-resonator piece is supported only by the end, and the other end is made into a free condition. Hereafter, with reference to a drawing, the example of the quartz resonator by this invention is explained.

[0023] Drawing 1 shows an example (it considers as an example 1 below) of this invention. The top view which a part of drawing 1 makes a cross section, the sectional view in the vertical plane where drawing 2 contains lead wire, and drawing 3 are the sectional views into which drawing 2 and 90-degree sense were changed. In drawing 1 - drawing 3 , 21 shows the conductive pedestal which consists of metal, for example, iron, or a 42 alloy alloy. The flange 22 of predetermined die length is formed so that a pedestal 21 may be extended from a base rear face to this and one over the perimeter. Two lead wire 25 (25a, 25b) which becomes two bores 23 prepared in this pedestal 21 from covar (Fe-nickel-Co alloy), nickel, etc. through glass (soft glass or hard glass) 24 is made to penetrate, glass welding of this is carried out, insulating fixing of lead wire 25 and the pedestal 21 is carried out in airtight, and the so-called hermetic base is formed.

[0024] Especially in this example, the quartz-resonator piece 27 which carried out horizontal-type arrangement is supported only by the end, and it constitutes so that it may be in the free condition of not fixing the other end. That is, installation fixing of the end of ( drawing 1 , drawing 2 , drawing 6 , referring to drawing 7 ), and the quartz-resonator piece 27 is carried out through electroconductive glue 28 at the part by the side of inner lead (head) 26 of one lead-wire 25a a, and one inner lead 25a of a

pedestal 21.

[0025] This quartz-resonator piece 27 is arranged at an abbreviation horizontal, namely, it is arranged at a horizontal type, and the other end of the quartz-resonator piece 27 is laid in the free condition of not being fixed, on inner lead (head) 26b of lead-wire 25b of another side.

[0026] In addition, as shown in drawing 4 , inner leads 26a and 26b are formed so that a head may become an area larger than the cross sectional area of lead wire 25 (25a, 25b) by header processing, respectively. Moreover, the width of face D of the glass welding of lead wire 25 (25a, 25b), i.e., the path of a bore 23, is accomplished so that it may become larger than the path d of inner leads (head) 26a and 26b.

[0027] And as shown in the quartz-resonator piece 27 at drawing 5 A and drawing 5 B, top-face electrode 27a is formed in a top face, and underside electrode 27b is formed in an underside, respectively. It pulls out at a central edge and top-face electrode 27a is the section 27a1. It is the drawer section 27a1 so that between the ends of the inner lead 26a and the quartz-resonator piece 27 of one lead-wire 25a may be connected, as it has and is shown in drawing 6 . And it connects with inner lead 26a electrically and mechanically through said electroconductive glue 28. On the other hand, it pulls out at a both-sides edge and underside electrode 27b is the section 27b1 and 27b2. It has, pulls out to the pedestal 21 of the part of the both sides which sandwich the bore 23 which inner lead 26a penetrates, and is the section 27b1 and 27b2. And it fixes electrically and mechanically through electroconductive glue 28 (refer to drawing 1 and drawing 7 ). That is, the quartz-resonator piece 27 fixes with electroconductive glue 28 in three by the side of an end.

[0028] Furthermore, inner lead (head) 26of lead-wire 25b of another side b and the pedestal 21 of the part of the outside of the bore around this lead-wire 25b are electrically connected through electroconductive glue 28. By this, a pedestal 21 will act as an element of electric circuitry, and underside electrode 27b of the quartz-resonator piece 27 will flow in inner lead 26b of another side through a pedestal 21. In addition, the edge of Electrodes 27a and 27b is retreated from inner lead 26b and electroconductive glue 28 so that lead-wire 25b of this another side, inner lead 26b and the electroconductive glue 28 on it, top-face electrode 27a of the quartz-resonator piece 27, and underside electrode 27b cannot be touched directly. The electroconductive glue of for example, a silver-epoxy system can be used for this electroconductive glue 28.

[0029] And it consists of metal, for example, iron, nickel silver (Cu-nickel-Zn alloy), etc. so that the crown-ed of said quartz-resonator piece 27 may be carried out, and the cap 29 which has the flange 22 of a pedestal and the corresponding flange 30 in one is arranged, a pedestal 21 and cap 29 are joined, and the quartz resonator 32 which sets a pedestal 21 and the outside surface of cap 29 as the object which carries out pre-insulation by the pre-insulation material 31, and changes further is constituted. In the container which consists of a pedestal 21 and cap 29, inert gas, for example,



nitrogen gas, is enclosed.

[0030] The pre-insulation material 31 can be formed by spreading of powder coatings, such as a coat for example, by a heat shrink nature tube etc., or an epoxy system.

[0031] According to this example, the quartz-resonator piece 27 by which horizontal-type arrangement was carried out is fixed by the end by the side of lead-wire 25a of one of these, and since the other end is in a free condition, it can absorb an oscillation and does not produce distortion of the quartz-resonator piece 27 etc. Therefore, frequency change of the quartz-resonator piece 27 in a production process can be prevented.

[0032] Moreover, since the quartz-resonator piece 27 fixes directly to a pedestal 21 and inner lead 26a, without minding supporter material and the path D of a bore 23 moreover makes it larger than the path d of inner leads (head) 26a and 26b, From isolation voltage being kept certain even if it shortens the distance l between inner leads (head) 26a and 26b and the hermetic base The height of the quartz-resonator piece 27 can be made low, the height of the quartz-resonator 32 whole can be made small by this, and components mark can also be reduced.

[0033] Furthermore, as shown in drawing 23 and drawing 24 , when the supporter material 4 is used, it is necessary to adjust but so that the direction of supporter material may be made into accuracy in a straight line, and in this example, since there is no directivity of inner lead 26a in order to fix the direct quartz-resonator piece 27 to inner lead 26a of a cross-section circle configuration, and adjustment of a direction becomes unnecessary, the production process of a quartz resonator is simplified.

[0034] Moreover, since pre-insulation of a part or the whole of a quartz resonator 32 is carried out by the pre-insulation material 31, in case this quartz resonator 32 is mounted in the circuit board, it can mount directly.

[0035] In addition, as the sectional view of the important section of a quartz resonator 32 is shown in drawing 8 , the other end which is in the free condition of the quartz-resonator piece 27 can also be considered as the configuration which floats from inner lead 26b under it. If it does in this way, even if the quartz-resonator piece 27 vibrates greatly, it does not hit with inner lead 26b, and generating of distortion of the quartz-resonator piece 27 by this collision can be prevented. Therefore, it is suitable to make especially a frequency into high degree of accuracy.

[0036] Drawing 9 - drawing 11 show other examples (it considers as an example 2 hereafter.) of this invention. In addition, in drawing 9 - drawing 11 , the same sign is given to drawing 1 - drawing 3 , and a corresponding part, and duplication explanation is omitted. This example to the quartz resonator 32 of an example 1 to the field which touches the circuit board Furthermore, a slot 42 is formed in installation and an insulation sheet 41 in an insulation sheet 41. It is processed so that the exterior 43 (43a, 43b) of lead wire 25 (25a, 25b), i.e., an outer lead, may bend in the place of an insulation sheet 41. The so-called chip type which comes to be inserted in the slot 42 of

this insulation sheet 41, lays in the circuit board directly and is connected to it of quartz resonator 40 is constituted. Other configurations are the same as that of an example 1.

[0037] According to this configuration, since pre-insulation of the whole quartz resonator 40 is carried out by the pre-insulation material 31, it can consider as a chip type easily. And by forming an insulation sheet 41 further and inserting an outer lead 43 in a slot 42, flattening of the whole underside surface where the outer lead 43 (43a, 43b) of the chip type quartz resonator 40 is bent can be carried out, and when a quartz resonator 40 is mounted in the circuit board, mounting stabilized to the circuit board can be aimed at.

[0038] Moreover, since the direct installation of the quartz resonator can be carried out on the circuit board, a tooth space can be saved. Furthermore, connection between lead wire and the circuit of the circuit board can be made easily.

[0039] Drawing 12 shows the important section of the example of further others of this invention (it considers as an example 3 hereafter). Although it is the configuration of having formed the insulation sheet 41, in drawing 9 - drawing 11 , the quartz resonator 70 of this example is the case where bent the outer lead 43 (43a, 43b) in the condition of having omitted this insulation sheet 41 and having been covered with the pre-insulation material 31, and it constitutes in a chip type. Other configurations are the same as that of drawing 9 - drawing 11 .

[0040] Therefore, in the quartz resonator 70 of this example 3, while doing so the same effectiveness as the example of a top, the abbreviation of an insulation sheet 41 can be aimed at.

[0041] In addition, although not illustrated, even if it does not cover the whole quartz resonator by the pre-insulation material 31 like the previous example 2, it is also possible by forming an insulation sheet 41 in the underside of a pedestal 21 directly to consider as a configuration which takes the insulation with a pedestal 21 and the circuit board, and carries out electrical installation of a pedestal 21 and the circuit board through lead wire 25.

[0042] Drawing 13 A and B shows the example of further others of this invention (it considers as an example 4 hereafter). In addition, in drawing 13 , the same sign is given to drawing 1 - drawing 3 , and a corresponding part, and duplication explanation is omitted. The auxiliary substrate 51 of insulation [ quartz resonator / 50 / of this example / top / pedestal 21 ] is formed, and the conductive pattern 52 of an abbreviation rectangle frame configuration is formed by the front face of the auxiliary substrate 51. The auxiliary substrate 51 has hole 51a of a little larger path than the path of inner leads 26a and 26b, as shown in drawing 14 A and drawing 14 B. Moreover, the auxiliary substrate 51 fixes by adhesives 53 grade to a pedestal 21.

[0043] Fixing and electrical installation are made with electroconductive glue 28 on the head of inner lead 26a like [ while ] the above-mentioned example by top-face electrode 27a of the quartz-resonator piece 27. And as shown in drawing 15 , as for underside

electrode 27b of the quartz-resonator piece 27, fixing and electrical installation are made by electroconductive glue 28 on the end of the conductive pattern 52 on the auxiliary substrate 51. The other end of the conductive pattern 52 on the auxiliary substrate 51 is electrically connected to inner lead 26b of another side through electroconductive glue 28.

[0044] The ceramics, glass, resist, etc. can constitute the insulating auxiliary substrate 51. When the ceramics constitutes the auxiliary substrate 51, one large ceramic plate in which the conductive pattern 52 was formed can be cut, many auxiliary substrates 51 can also be formed, and, thereby, simplification of a production process can be attained.

[0045] On the other hand, when glass constitutes the auxiliary substrate 51, it can form by welding like the insulating glass 24 in a bore 23. At this time, the conductive pattern 52 makes the frame of the metal conductive pattern 52 created beforehand print and carry out temporary baking of the insulating glass, lays this glass side in a pedestal, doubles a location, welds glass after that, and forms the auxiliary substrate 51. In addition, in order to decrease stray capacity, printing and welding of insulating glass are made good also as not the whole surface but the so-called point attachment performed selectively.

[0046] Drawing 16 A and B and drawing 17 show the example of further others of this invention (it considers as an example 5 hereafter). Drawing 17 is a sectional view on the R-R' line of drawing 16 A. In addition, in drawing 16 and drawing 17, the same sign is given to drawing 13 - drawing 15, and a corresponding part, and duplication explanation is omitted.

[0047] The quartz resonator 60 of this example is replaced with an elliptical pedestal, the glass auxiliary substrate 61 which consists of insulating glass (for example, elasticity, hard, or glass ceramics) is formed on the small pedestal 21 of the shape of a square which removed the semicircle part of the ends, and the conductive pattern 52 of an abbreviation rectangle frame configuration is formed in the front face of the glass auxiliary substrate 61. As the glass auxiliary substrate 61 is shown in drawing 18 A and drawing 18 B, it is formed in an abbreviation rectangle frame configuration like the conductive pattern 52, and a cross section is formed in an abbreviation trapezoid configuration with an up-and-down parallel field.

[0048] And an insulation sheet 41 is directly formed in the field of the pedestal 21 which touches the circuit board which mounts a quartz resonator 60 like the example 2 shown in drawing 10, and the exteriors (outer lead) 43a and 43b of lead wire 25a and 25b penetrate this insulation sheet 41, and are inserted in the slot 42 established in the insulation sheet 41. That is, the chip type quartz resonator 60 is constituted.

[0049] Top-face electrode 27a of the quartz-resonator piece 27 fixes electrically and mechanically through electroconductive glue 28 to one inner lead 26a, and, as for underside electrode 27b, fixing and electrical installation are made by electroconductive glue 28 on the conductive pattern 52 on the auxiliary substrate 51. The other end of

underside electrode 27b is electrically connected to inner lead 26b of another side through electroconductive glue 28. In addition, even if the quartz-resonator piece 27 lays a front flesh side in reverse, it presupposes that it is good.

[0050] In this case, the glass auxiliary substrate 61 can be formed by welding like the insulating glass in a bore 23. At this time, the conductive pattern 52 makes the frame of the metal conductive pattern 52 created beforehand print and carry out temporary baking of the insulating glass, lays this glass side in a pedestal 21, doubles a location, welds glass after that, and forms the glass auxiliary substrate 61. Also in this case, printing and welding of insulating glass are made good also as point attachment as mentioned above.

[0051] Moreover, in this example 5, by the adhesives 53 for attaching an auxiliary substrate in a pedestal 21 becoming unnecessary as compared with the quartz resonator 50 of an example 4, and it becoming unnecessary providing the tooth space of the part which attaches those adhesives, the horizontal die length of a quartz resonator 60 can be shortened, and, thereby, a quartz resonator 60 is miniaturized more.

[0052] Drawing 19 shows the example of further others of the quartz resonator of this invention (it considers as an example 6 hereafter). Drawing 19 is a sectional view in the field containing an inner lead. This example is the case where the ends of a quartz-resonator piece fix on an inner lead with the electroconductive glue which has resiliency. In addition, in drawing 19, the same sign is given to each example shown in drawing 1 - drawing 16, and a corresponding part, and duplication explanation is omitted.

[0053] Also in the quartz resonator 80 of this example, two bores 23 prepared in the conductive pedestal 21 are made to penetrate lead wire 25 (25a, 25b) through insulating glass 24, insulating fixing is carried out by glass welding in airtight, and lead wire 25 and a pedestal 21 change by it. 27 shows a quartz-resonator piece and 29 shows a cap.

[0054] In the quartz resonator 80 of this example especially And the inner leads 26a and 26b of a couple, The quartz-resonator piece 27 has been arranged on the large head of the path of lead wire 25, and inner leads 26a and 26b and the quartz-resonator piece 27 have fixed through the electroconductive glue 81 which has resiliency. At namely, this time Top-face electrode 27a of the quartz-resonator piece 27 and underside electrode 27b are electrically connected to each inner lead 26a and 26b through the electroconductive glue 81 which has resiliency, and the flow with the quartz-resonator piece 27 with lead wire 25 is achieved. In drawing 19, top-face electrode 27a is connected to inner lead 26a, and underside electrode 27b is connected to inner lead 26b.

[0055] A denaturation urethane system or silicone system resin, and the flexible nature elastic electroconductive glue that used silver, nickel, or carbon as an electric conduction agent are used for the electroconductive glue 81 which has resiliency as a binder. Since after hardening presents the shape of rubber and this electroconductive glue is excellent in flexible nature, the effect on the quartz-resonator piece by hardening

contraction hardly produces it. Moreover, there is no degree-of-hardness change by temperature to low warm elevated temperatures, and it has the features that after heat aging maintains rubber elasticity. In the case of this elastic electroconductive glue, the degree of hardness of the usual epoxy system electroconductive glue is B - 6B and a quite soft degree of hardness to being an equivalent for 4H by the pencil degree of hardness (JIS.K5400).

[0056] Moreover, since adhesives with which a volatile constituent is gradually emitted after fixing affect the ambient atmosphere in a quartz resonator, they are not used for the electroconductive glue 81 which has resiliency.

[0057] Also in the quartz resonator 80 of this example 6, by not using supporter material, the height of that part quartz-resonator piece 27 can be made low, and the height of the quartz-resonator 80 whole can be made low. Therefore, the miniaturization of a quartz resonator 80 is attained.

[0058] Moreover, since the quartz-resonator piece 27 is fixed to inner leads 26a and 26b with the electroconductive glue 81 which has resiliency, the stress which joins a quartz-resonator piece at the time of manufacture is absorbed by the resiliency of adhesives 81, and can prevent fluctuation of the frequency of the quartz-resonator piece 27 resulting from stress.

[0059] Furthermore, by this example, since the direct quartz-resonator piece 27 is fixed to inner leads 26a and 26b through the electroconductive glue 81 which has resiliency, the mark of components can be reduced and simplification of a production process can be attained.

[0060] Moreover, the quartz resonator 80 of this example 6 is also applicable to the chip type quartz resonator of the above-mentioned example 2 grade. As shown in drawing 20, the chip type quartz resonator 85 can be constituted like the example 2 grade shown in drawing 10 by bending an insulation sheet 41 on the underside of a pedestal 21, bending an outer lead 43 into the slot 42 of installation and an insulation sheet 41, and inserting in.

[0061] In addition, in each above-mentioned example, a pedestal 21 can be thinly formed by selecting the ingredient of a pedestal 21 and controlling reinforcement. The height of the whole quartz resonator can be made low by this, and the miniaturization of a quartz resonator can be attained.

[0062] The quartz resonator of this invention is not limited to an above-mentioned example, and, in addition to this, various configurations can take it in the range which does not deviate from the summary of this invention.

[0063]

[Effect of the Invention] According to the quartz resonator of above-mentioned this invention, by fixing a quartz-resonator piece to lead wire by the end, and making the other end into a free condition, deformation resulting from the difference in coefficient of thermal expansion with the pedestal accompanying the distortion and the temperature

change to the quartz-resonator piece in a production process etc. is prevented, and fluctuation is not produced in the frequency beforehand set as the quartz-resonator piece. Therefore, by this invention, the precision of the frequency of a quartz resonator can be kept good and the dependability of a quartz resonator can be raised.

[0064] Moreover, when the end of a quartz-resonator piece fixed into the part by the side of one inner lead and one inner lead of a pedestal, while the other end will be in a free condition and keeps the precision of the frequency of a quartz resonator good, the height of the part quartz-resonator piece which does not use supporter material etc. can be made low, and, thereby, the height of the whole quartz resonator can be made low. Furthermore, when one electrode of a quartz-resonator piece flowed in one inner lead and the electrode of another side has flowed in the inner lead of above-mentioned another side through a pedestal, the other end of a quartz-resonator piece can be flowed through each electrode of a quartz-resonator piece also as a free condition.

[0065] Also when the end of a quartz-resonator piece is fixed on the auxiliary substrate formed on the pedestal instead of the pedestal and it is made to flow through the electrode of another side of a quartz-resonator piece, while the other end will be in a free condition similarly and keeping the precision of the frequency of a quartz resonator good The height of the part quartz-resonator piece which does not use supporter material etc. can be made low, and it has the effectiveness which makes the height of the whole quartz resonator low by this, and the other end of a quartz-resonator piece can be flowed through each electrode of a quartz-resonator piece also as a free condition.

[0066] When the ends of a quartz-resonator piece are made to fix with the electroconductive glue which has resiliency on the inner lead of a couple, stress is absorbed with the resiliency of adhesives and the precision of the frequency of a quartz resonator is kept good, and the height of the part quartz-resonator piece which does not use supporter material etc. can be made low, and it has the effectiveness which makes the height of the whole quartz resonator low by this. Moreover, the reduction effectiveness of components mark and the number of production processes is large.

[0067] And according to this invention, since the height of a quartz resonator can be made low, the miniaturization of the equipment incorporating a quartz resonator can be attained. Moreover, since components mark can be reduced since supporter material is not used, and adjustment of directivity becomes unnecessary, a production process can be simplified.

[0068] Although the Wakebe articles of an auxiliary substrate increase in number in using an auxiliary substrate, it is possible to manufacture the auxiliary substrate of a large quantity at once, and simplification of a production process can be attained.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the top view of one example of the quartz resonator of this invention made into a cross section in part.

[Drawing 2] It is a sectional view by the cross section containing the lead wire of the quartz resonator of drawing 1 .

[Drawing 3] It is the sectional view into which drawing 2 and 90-degree sense of a quartz resonator of drawing 1 were changed.

[Drawing 4] It is the outline block diagram of the important section near the lead wire of the quartz resonator of drawing 1 .

[Drawing 5] A, B It is drawing showing the quartz-resonator piece of the quartz resonator of drawing 1 .

[Drawing 6] It is drawing showing the condition of connection of the top-face electrode of the quartz-resonator piece of the quartz resonator of drawing 1 .

[Drawing 7] It is drawing showing the condition of connection of the underside electrode of the quartz-resonator piece of the quartz resonator of drawing 1 .

[Drawing 8] It is an outline block diagram in the case of floating a quartz-resonator piece from an inner lead.

[Drawing 9] It is the top view of other examples of the quartz resonator of this invention made into a cross section in part.

[Drawing 10] It is a sectional view by the cross section containing the lead wire of the quartz resonator of drawing 9 .

[Drawing 11] It is the sectional view into which drawing 10 and 90-degree sense of a quartz resonator of drawing 9 were changed.

[Drawing 12] It is the outline block diagram of the important section of the example of further others of the quartz resonator of this invention.

[Drawing 13] It is the outline block diagram of still more nearly another example of the quartz resonator of this invention.

A It is the top view made into a partial cross section.

B It is a sectional view by the cross section containing lead wire.

[Drawing 14] It is the block diagram of the auxiliary substrate of the quartz resonator of drawing 13 .

A It is the top view of an auxiliary substrate.

B It is a sectional view in Q-Q' of drawing 14 A .

[Drawing 15] It is the block diagram of the important section explaining the connection condition of the quartz resonator of drawing 13 .

[Drawing 16] It is the outline block diagram of still more nearly another example of the quartz resonator of this invention.

A It is the top view made into a partial cross section.

B It is a sectional view by the cross section containing lead wire.

[Drawing 17] It is a sectional view in R-R' of drawing 16 A.

[Drawing 18] It is the block diagram of the glass auxiliary substrate of the quartz resonator of drawing 16.

A It is the top view of a glass auxiliary substrate.

B It is a sectional view in A-A' of drawing 18 A.

[Drawing 19] It is the outline block diagram (sectional view) of still more nearly another example of the quartz resonator of this invention.

[Drawing 20] It is an outline block diagram (sectional view) at the time of applying the quartz resonator of drawing 19 to a chip type.

[Drawing 21] It is the outline block diagram (sectional view) of the example of the conventional quartz resonator.

[Drawing 22] It is the sectional view of the important section with which explanation of the conventional example is presented.

[Drawing 23] It is drawing showing the configuration of the conventional supporter material.

[Drawing 24] A, B It is drawing showing the configuration of other conventional supporter material.

[Description of Notations]

21 Pedestal

22 30 Flange

23 Bore

24 Insulating Glass

25, 25a, 25b Lead wire

26a, 26b Inner lead (head)

27 Quartz-Resonator Piece

27a Top-face electrode

27b Underside electrode

28 Electroconductive Glue

29 Cap

31 Pre-insulation Material

32, 40, 50, 60, 70, 80, 85 Quartz resonator

41 Insulation Sheet

42 Slot

43, 43a, 43b Outer lead (exterior)

51 Auxiliary Substrate

52 Conductive Pattern

53 Adhesives

61 Glass Auxiliary Substrate

81 Electroconductive Glue Which Has Resiliency

D The path of a bore



d The path of an inner lead